Ph(r)ase Transition:
A Generatively Constructed Interactive Visual and Poetic Environment

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Abstract

The state change from solid to liquid is an example of a phase transition in a thermodynamic system. Similarly imagined, a poetic phrase transition might be exemplified by a semantic or typographic state change affecting the meaning of lexical representations of text fragments. Within the interactive generative environment we have developed, both types of transition are interwoven in the visualization of iceberg data, water currents, and poetic phrases that appear and evolve. Iceberg forms take their initial position and size from International Ice Patrol (IIP) iceberg sighting data. After being spawned, they exhibit slow melting and drifting behaviors that can be interactively accelerated and influenced by the movement of an observer using the Microsoft Kinect motion-sensing camera. Simultaneously, poetic textual phrases are spawned, evolving with a set of related but distinct behaviors, and interacting within the environment. User interaction re-locates the phrases and influences the reading of the texts.

1. Background and Motivation

The authors have been working collaboratively on a number of interdisciplinary projects under the auspices of the Ammerman Center for Arts and Technology at Connecticut College (New London, CT, USA). The mission of the Center is to facilitate creative collaboration and experimental investigation at the intersections of Arts and Technology, forging interdisciplinary partnerships and creating opportunities for students and scholars to think outside of disciplinary boundaries.

Over the last ten years, the authors have worked on several interactive and generative audiovisual installation pieces featuring poetry, video processing, sound and audio processing, virtual reality exploration and intelligent agent-based software. The current work developed from, and extended, research on the northern arctic environment.

To begin with, we established a set of core guiding principles that would govern our investigation. These included:

1. Interest in explorations that visualize environmental data and in working with The International Ice Patrol Center in New London, CT which is part of the United States Coast Guard Academy

2. Development of agent based models applied to generative visual art that are representations of iceberg data

3. Incorporation of contextually sensitive poetic text that iteratively develops and is responsive to user movement

2. Visual Elements and Prior Work

The work *Ph(r)ase Transition* evolved from a prior work entitled *Drifting*, that was exhibited at a gallery exhibition titled *Between Solid and Liquid: Constructed Landscapes* at the Konstepidemin in Gothenburg, Sweden during May 2014. The motivation for *Drifting* was to combine a dynamic visualization of iceberg data with gestural recognition interactivity based on the use of a Kinect sensor. During the realization of that work, a number of possible data sources for iceberg data were considered. The most prevalent form of available data is in the form of sighting data, and consists of position, size, shape and sighting time. These datasets are available per year for geographical areas in which icebergs drift, such as the Grand Banks of Newfoundland. There are also a few datasets involving tracking of individual icebergs, showing their movement patterns, but, in general, these are dated and harder to obtain.

Figure 1. Icebergs in Disko Bay, Greenland (Getty Images).

During the course of the work, the authors established a working relationship with the United States International Ice Patrol (IIP), a branch of the U.S. Coast Guard. The IIP's mission is to monitor the iceberg danger near the Grand Banks of Newfoundland and provide the iceberg information to the maritime community. The IIP was established as a direct result of the tragic sinking of the RMS Titanic in 1912. Greenland glaciers calve thousands of icebergs each year with an average of 500 drifting south to threaten transatlantic shipping. IIP iceberg data is entered into a

computer model that uses ocean current and wind data to predict iceberg drift and deterioration.

In order to best combine the interactive Kinect sensor with the iceberg data, the Java-based Processing visual programming language was used, as it provides a robust and flexible platform for generative 2D and 3D graphics, and has good support for the Kinect using open source libraries. An iceberg dataset with over 6000 sightings from 2011 was used as the basic for the iceberg visualizations. The data includes an ID for each iceberg, sight time, latitude and longitude, sight method, size and shape of iceberg.

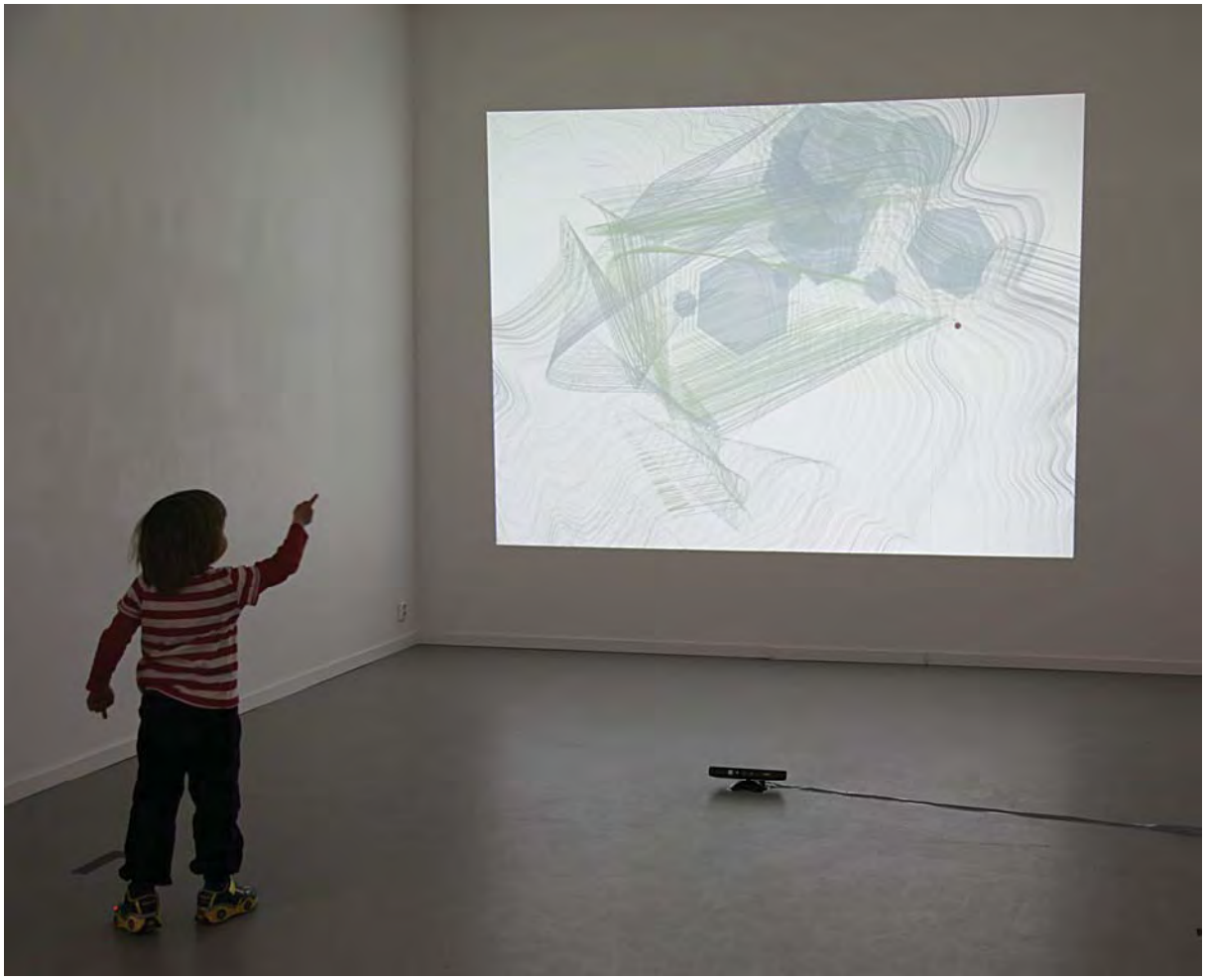

Figure 2. "Drifting" interactive visualization work on exhibit at Konstepidemin Gallery, Gothenburg, Sweden. May 2014.

To create an engaging interactive work, the authors experimented with a number of visual elements, ultimately deciding on a background of undulating current textural lines combined with hexagonal iceberg forms with linear outlines. Icebergs are spawned from the 2011 sighting dataset using the position and size parameters. These icebergs are spawned with the virtual environment, they slowly shrink and fade using a behavior that connotes gradual melting.

For the interactive engagement, the gestural recognition is depicted with a red dot that influences the currents and, as proximity to the icebergs increase, accelerates

the ‘melting’ behavior of the icebergs. For many participants in the installation in Sweden, the accelerated melting caused by user intervention reminded them of issues related to global climate change and many wished to avoid melting the icebergs any faster. To the authors, this response to the work was an interesting discovery.

3. Overall Structure and Generative Art Processes

The background of the virtual environment includes undulating currents upon which the icebergs randomly appear. These icebergs may be represented by either hexagonal forms or text fragments. Interaction may occur with either a Kinect motion-sensor or with keyboard arrows. This interaction affects both currents and icebergs. The icebergs move and evolve even if there is no interaction. (figure 3).

Figure 3. Screenshot of “Ph(r)ase Transtion”

The parameters of the iceberg sighting data were used to control the size, opacity, color, location and evolution behavior of all icebergs, whether represented by text fragments or hexagonal forms. A set of visual and interactive behaviors was developed for the textual and hexagonal icebergs as well as the water current representations. With regard to the Kinect or keyboard ‘paddle’ interaction, the behavior was classified into two modes of behavior: default ‘uninterruped’ behaviors when the paddle was far way, and ‘intentional’ behaviors when the user is deliberately trying to interact with the text fragments, hexagonal forms and water currents by moving the paddle towards and near these objects in the environment.

Text Elements

Drifting was conceived of as an evolutionary work. In considering the next direction of the work, we sought a less literal representation of the visual iceberg forms and melting behaviors. Towards that end, we decided to experiment with the typographic and semantic properties of poetic text fragments. We selected excerpts from the following:

- Shakespeare's *The Tempest* and *Antony and Cleopatra*
- *Snow-Bound: A Winter Idyl* by John Greenleaf Whittier
- Numerous poems by the contemporary poet Ansie Baird
- *The Moment* and *The Waking* by Theodore Roethke.

These poetic texts were chosen because they each included phrases depicting modes of transition, the environment and natural forces, the northern landscape and light, and the human condition. Additionally, these texts worked well in combination, with a variety of interesting readings occurring when the passages were juxtaposed and recombined.

Below are two sample text passages:

> *Our revels now are ended. These our actors,*
> *As I foretold you, were all spirits and*
> *Are melted into air, into thin air.*
> *And like the baseless fabric of this vision,*
> *The cloud-capped towers, the gorgeous palaces …*
> —Spoken by Prospero in Shakespeare's *The Tempest*

> *I would like you to believe*
> *The oceans are kind,*
> *Keeping each island afloat*
> *In all weather. You will*
> *Be to each other a kind of*
> *Island, separate and entire.*
> *Together you will gather*
> *Tide-tossed shards*
> *In your hands.*
> — Ansie Baird's poem "*I Would Like to Tell You*"

We parsed the poems down to phrases using a generative approach both as the mechanism to break down the phrases and also for the order in which these phrases appear. Additionally, each time the program runs or is reset, a different author is randomly chosen.

Generative elements in Processing

The program is written using the Processing software and includes many generative and random elements. The following is a summary of elements as codified by the software:

- Water currents are initially set up in a generative manner.
- The author of textual icebergs is chosen randomly from the list of chosen authors.
- The appearance of a particular iceberg is generated randomly from the dataset although the position and mass of that iceberg is determined, within small fluctuations, by the dataset.
- The program randomly decides whether a given iceberg will be hexagonal or textual; greater probability is assigned to the appearance of textual icebergs.
- Textual icebergs acquire their phrases through a generative process that both divides phrases and shuffles the order in which those phrases appear.
- Textual icebergs are randomly assigned one of two behaviors. One of those behaviors causes the iceberg to grown larger and lighter and thus transition from a solid to a gas. The other behavior causes the iceberg to transition to a smaller and more dense phase.
- The textual icebergs that transition to a smaller, denser state will either disappear entirely or acquire a permanence and immortality; these choices are determined randomly.

4. Behaviors

The behaviors of the three elements (typographic, hexagon forms, and line currents) in the “Ph(r)ase Transition” environment are dynamic both in their uninterrupted and intentional states. In the uninterrupted state all of the elements gently undulate as if they are suspended, but controlled by a larger force. Uninterrupted, the environment continues to acquire poetic text and hexagonal forms, creating a layered and thick environment where poetic phrases appear on top of the hexagonal forms and the linear elements. Poetic texts may grow larger and evaporate or may get smaller and more dense and some of them will disappear entirely. The hexagonal forms will very gradually evaporate.

Using the Kinect or keyboard, the intentional behaviors create an active gestural space where the poetic phrases move, many growing in size and becoming transparent. The hexagonal forms also continue to accumulate and as the user gets close to the hexagonal forms, the forms reduce more quickly in size and disappear rapidly. The line (current) elements continue to gently move and are reshaped as the user interacts with them.

The eventual disappearance of all the hexagonal forms, in contrast to the permanence of some of the textual forms expresses a belief about the power of poetry. In contrast to the ephemeral nature of ice, some words, even though they grow out of the imagination and seem to have no physical embodiment, do possess a certain kind of immortality. This current project makes use of virtual environmental interaction to more broadly reflect the role of human influence in transitions, weaving together the melting of icebergs and the recombination and displacement of poetic texts to suggest some deeper visual and semantic relationships in play.

Typographic Behaviors

The position of the poetic text in the environment is determined by specific longitude and latitude coordinates from the iceberg sighting data. The font size and color represents different sizes of icebergs from the sighting data.

	size	opacity/color	location/change
no paddle	sizes determined by iceberg data _extra small _small _medium _large _extra large	_initially randomly determined to become lighter (opacity) & larger, or darker (opacity) & smaller _color determined by data	_no large movement just slight current movement
paddle	_paddle does not affect size of font	_paddle does not affect opacity or color _some small sized phrases disappear, others are not affected by paddle	_ nudged in direction of paddle movement _can be nudged again after a period of time _some small phrases do not move

Figure 4. Typographic qualities for uninterrupted and intentional behaviors

The poetic text is randomly generated and, in its uninterrupted state, some texts continue to expand and lighten, a gesture representing the phase transition state from liquid to gas. Other texts become smaller but increase their opacity.

With Intentional behaviors (use of paddle), the poetic text can be moved within the environment and off of the screen. Figure 4 shows the typographic behaviors with and without the interaction. The use of the paddle allows the user to relocate poetic phrases, and dissolve some phrases all together. There are random smaller phrases that do not move, that may disappear, and some may stay in the same position, size and opacity.

Hexagonal behaviors

	size	opacity/color	location/change
no paddle	_sizes determined by iceberg data with slow decrease in size	_transparency increases slowly	_slight current movement _small forms have more noise movement
paddle	_paddle affects the rate of size reduction	_paddle increases the rate of transparency	_paddle has no effect of movement of forms

Figure 5. Hexagonal qualities for uninterrupted and intentional behaviors

In addition to poetic phrases, the hexagonal forms also are visualizations of iceberg data. The hexagonal forms appear in different sizes, with differing numbers of outlines. When the user approaches the hexagonal forms (intentional behaviors) the forms begin to get smaller and more quickly disappear, a gesture representing the melting process of ice, phase transition from solid to liquid. All of the hexagonal forms have slight movement in both states and the smaller forms have a faster, more nervous movement.

Currents behaviors

	size in length	***opacity/color***	***location/change***
no paddle	_no effect	_no effect	_slight undulating movement
paddle	_paddle affects shape of lines	_no effect	_lines move in direction of paddle, then slowly return to original location

Figure 6. Current (lines) qualities for uninterrupted and intentional behaviors

The line elements in the environment represent the currents of the water. They move gently without any interaction, providing a ground and dimensionality to the visual field. When the user interacts within the space, the directions of the lines are pulled by the paddle but eventually return to their original state.

5. Summary and Future Directions

This collaborative work of generative art is a poetic visualization based on scientific data from the International Ice Patrol. It uses the flexibility of the digital to create a more randomized, unpredictable and interactive interpretation of the IIP data. This work makes use of virtual environmental interactions to more broadly reflect the role of our influence in transitions, weaving together the melting of icebergs and the recombination and displacement of poetic texts to suggest a deeper visual and semantic relationship at play.

Additional plans for this environment are to give the user more control over the movement and placement of the poetic phrases. We envision this project as an outdoor interactive installation accessible by a larger public.

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